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Khlat et al.

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(54) **APPARATUS FOR RECEIVING AND PROCESSING A RADIO FREQUENCY SIGNAL**

(75) Inventors: **Nadim Khlat**, Cugnaux (FR); **Patrick Clement**, Bussigney (CH)

(73) Assignee: **Motorola, Inc.**, Schaumburg, IL (US)

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(22) Filed: **Mar. 24, 2000**

(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**[7] **H04B 1/10**
(52) **U.S. Cl.** **375/350**; 455/307; 455/310
(58) **Field of Search** 375/261, 284, 375/285, 316, 324, 340, 346, 350; 455/43, 50.1, 63, 283, 286, 296, 303, 307, 310; 708/300; 329/318, 320, 349, 353

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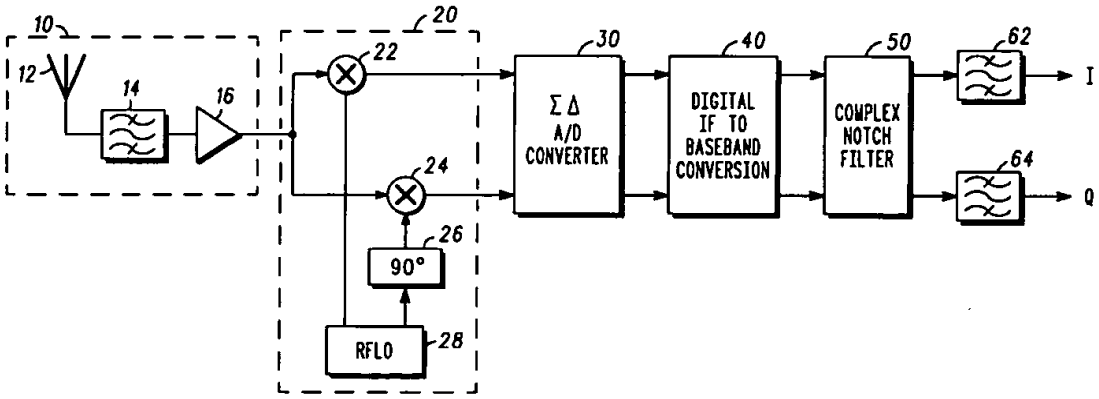
Primary Examiner—Stephen Chin
Assistant Examiner—Dac V. Ha

(57) **ABSTRACT**

Apparatus **20,30,40,50** for receiving and processing a wanted Radio Frequency signal comprises a radio frequency to intermediate frequency down-conversion stage **20** for receiving the wanted radio frequency signal and out-putting a complex intermediate frequency signal; an analogue to digital converter **30** for converting the complex intermediate frequency signal to a digital complex intermediate signal; an intermediate frequency to base-band down-conversion stage **40** for receiving the digital complex intermediate frequency signal and out-putting a digital complex base-band signal; and a complex notch filter **50** for receiving the digital complex base-band signal and out-putting a notch filtered digital complex base-band signal wherein the complex notch filter **50** substantially filters out a small portion of the base-band signal centred about a first, non-zero, frequency while substantially passing a corresponding portion of the base-band signal centred about a second frequency having the same magnitude but opposite sign to the first frequency.

15 Claims, 3 Drawing Sheets



de as the band-width of the wanted signal.

Detailed Description Text - DETX (14):

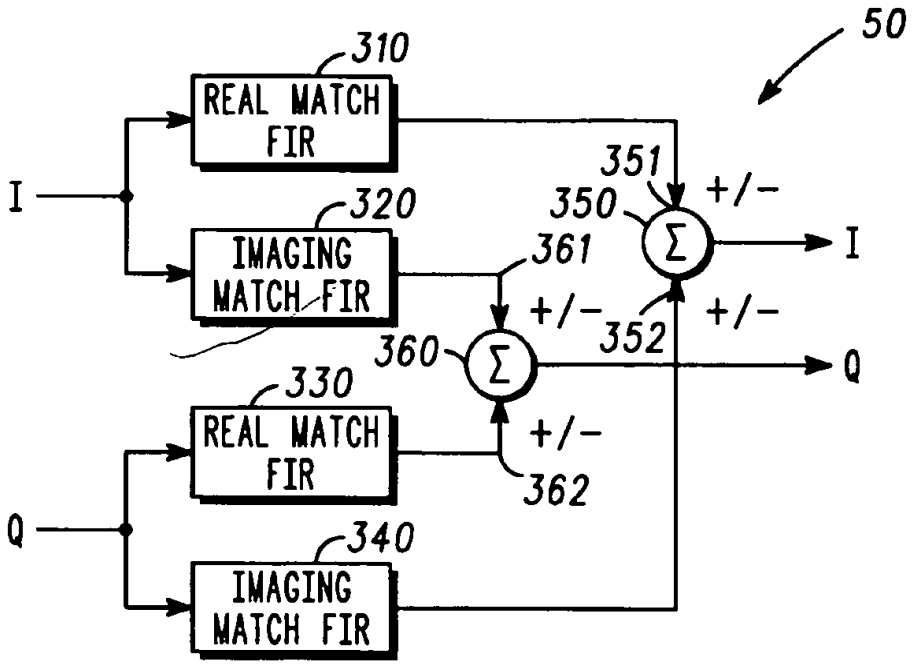
Turning now to FIG. 3, the block diagram illustrates a possible high level arrangement for complex notch filter 50. From FIG. 3 it can be seen that complex notch filter 50 comprises a first real notch Finite Impulse Response (FIR) filter 310, a first imaginary **notch FIR filter, a second real notch** FIR filter 330 and a **second imaginary notch** FIR filter 340. Complex notch filter 50 also includes a first adder/subtractor 350 having a first input 351 and a second input 352 and a second adder/subtractor 360 having a first input 361 and a second input 362. The first real and imaginary notch FIR filters 310, 320 are adapted to receive the I component of the complex base-band signal and the **second real and imaginary notch** FIR filters 330, 340 are arranged to receive the Q component of the base-band signal as output by the IF to base-band down-conversion stage 40 of FIG. 1. The output of the first real and imaginary notch FIR filters 310, 320 are input to the first input 351, 361 of the first and second adder/subtractors 350, 360 respectively. Similarly, the **second real and imaginary notch** FIR filters 330, 340 are input to the second inputs 362, 352 of the second and first adder/subtractors 360, 350 respectively.

Detailed Description Text - DETX (29):

Thus, turning back to FIG. 3, one can see that the first and **second real notch** FIR filters 310,330 are really just normal FIR filters with coefficients C.sub.i0, C.sub.i1, C.sub.2 . . . and the first and **second imaginary notch** FIR filters 320,340 are just normal FIR filters with coefficients C.sub.q0, C.sub.q1, C.sub.q2 . . . Furthermore, one can see that the normal desired settings for the inputs 351,352,361, 362 to the adder/subtractors 350,360, would be to have all of the inputs 351, 361, 362 as non-inverting or adding inputs except for the second input 352 of the first adder/subtractor 350. However, to shift the response of the filter in the other direction, one would invert the inputs 361, 352 to the adder/subtractors 360, 350 which are receiving the signals from the first and **second imaginary notch** FIR filters 320, 340. This is apparent when considering that e.sup.j.omega..sup..sub.shift .sub..tau. =cos(.omega..sub.shift.tau.)+i sin(.omega..sub.shift.tau.) and e.sup.-j.omega..sup..sub.shift .sub..tau. =cos(.omega..sub.shift.tau.)-i sin(.omega..sub.shift.tau.).

Claims Text - CLTX (4):

4. Apparatus as claimed in claim 1 wherein the radio frequency


50
310
REAL MATCH FIR
320
IMAGING MATCH FIR
330
REAL MATCH FIR
340
IMAGING MATCH FIR
I
Q
351
350
361
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352
362
+/-
+/-
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Σ
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FIG. 3